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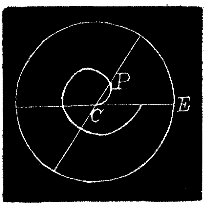
50. Proposed by GEORGE LILLEY, Ph. D., LL. D., Principal of Park School, 394 Hall Street, Portland, Oregon.

A draw bridge, a feet in length, moves uniformly about a center axis. At the instant it began to open, a man stepped on the end; and, walking at a uniform rate in the straight line passing through its center, reached the opposite end just as it made n complete revolutions. Find the absolute path described by the man, and the ratio of his rate of motion in this path and the velocity of the end of the bridge. Apply the result to the case when $a=320$, and $n=2$.

Solution by E. L. SHERWOOD, A. M., Professor of Mathematics in Mississippi Normal College. Houston, Mississippi.



Let the man start at C and walk toward E, the table turning positively. He will traverse R, while the table turns $\frac{n}{2}.2\pi$. As velocities are uniform, we have,

$$CP : PCE :: R : \pi n, \text{ or } \rho : \theta :: R : \pi n,$$

whence $\rho=\frac{R\theta}{\pi n}$ is the equation of the curve.

As $dl=[(\rho d\theta)^2+d\rho^2]^{\frac{1}{2}}$ we have,

$dl=\frac{R}{\pi.n}(1+\theta^2)^{\frac{1}{2}}\,d\theta$ for this curve, and

$$2l=\frac{2R}{\pi.n}\int_0^{\theta'}[1+\theta^2]^{\frac{1}{2}}\,d\theta, \text{ and}$$

$$L=\frac{2R}{\pi.n}\left[\frac{\theta}{2}(1+\theta^2)^{\frac{1}{2}}+\tfrac{1}{2}\log(\theta+\sqrt{1+\theta^2})\right]_0^{\pi.n}$$

$$L=\frac{R}{\pi.n}[\pi.n(1+\pi^2.n^2)^{\frac{1}{2}}+\log(\pi.n+\sqrt{1+\pi^2.n^2})].$$

If $a=100$ feet, and $n=2$,

$$L=\frac{50}{2\pi}[2\pi\sqrt{1+4\pi^2}+\log(2\pi+\sqrt{1+4\pi^2})]=338.3.$$

[No. 41, *Calculus.*]

If $a=36$ inches, and $n=1$, we have,

$$L=\frac{18}{\pi}[\pi\sqrt{1+\pi^2}+\log(\pi+\sqrt{1+\pi^2}]=69.6+ \text{ inches.}$$

[No. 45, *Calculus.*]

If $a=320$, and $n=2$, we have,

$$L=\frac{160}{2\pi}[2\pi\sqrt{1+4\pi^2}+\log(2\pi+\sqrt{1+4\pi^2})]=1082.56 \text{ feet.}$$

[No. 50, *Calculus.*]

The ratio of rates of extremity of the bridge and the man in his path is:

$$\frac{a}{2}\,d\theta\div dl=\frac{\pi n}{\sqrt{1+\theta^2}}.$$

The ratio of rates of extremity of bridge and the man's *walking* is:

$$\frac{\pi an}{a}=\pi n.$$

Also solved by *G. B. M. ZERR* and *C. W. M. BLACK.*

PROBLEMS.

57. **Proposed by F. M. McGAW. A. M., Mathematical Department, Bordentown Military Institute, Bordentown, New Jersey.**

Solve the following equation : $(1+x^2)\dfrac{d^2y}{dx^2}-2x\dfrac{dy}{dx}+2y=0.$

58. **Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics in New Windsor College, New Windsor, Maryland.**

A line passes through a fixed point and rotates uniformly about this point. Another line passes through a point which moves uniformly along the arc of a given curve and rotates uniformly about this point. Develop a method for finding the locus of intersection of these two lines. Apply to case of circle and straight line.

MECHANICS.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

32. **Proposed by OTTO CLAYTON, A. B., Fowler, Indiana.**

The wheel of a wind pump has 60 fans, each turned at an angle of 45° to the direction of the axis, and each having 150 square inches exposed to the wind. If the wind blows with a velocity of V and the wheel rotates with velocity ω, what is the component of force or pressure along the axis if it is turned at an angle α to the direction of the wind, assuming the resistance of the wheel in turning to be R?

No solution of this problem has been received.